

التقليم –الوضع ضمن نافذة-التعبئة

- التقليم Clipping

تقليم مستقيم

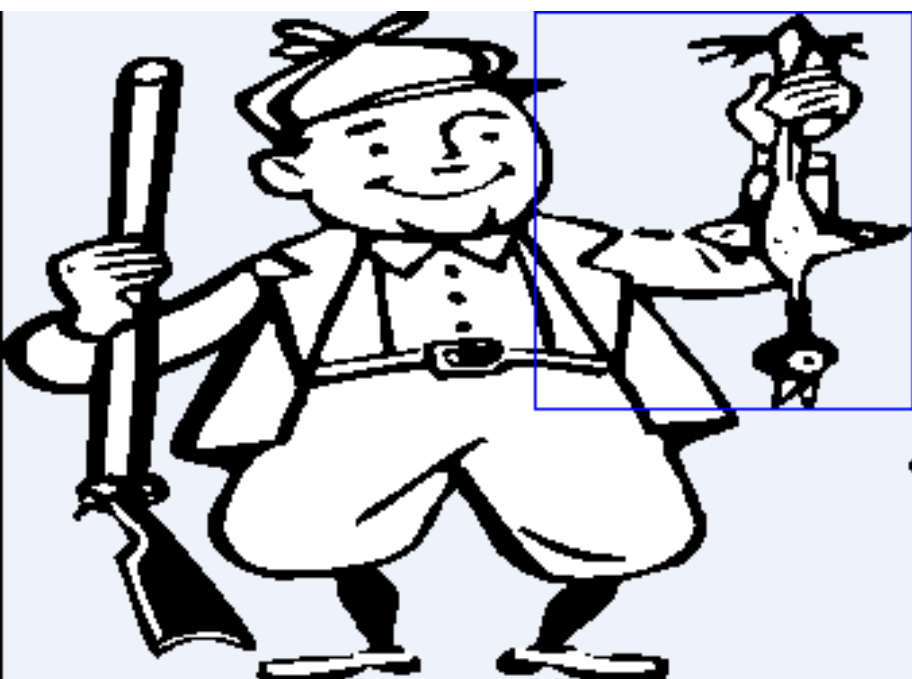
تقليم مضع

- الوضع ضمن نافذة Windowing

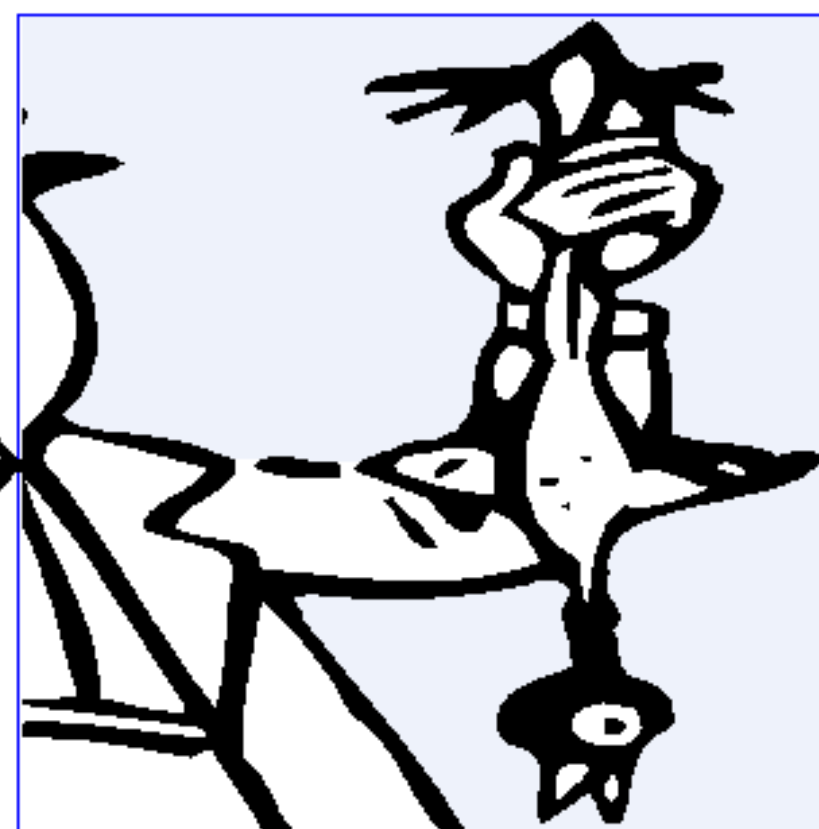
- التعبئة Filling

الطريقة البسيطة

طريقة انتاش البذرة



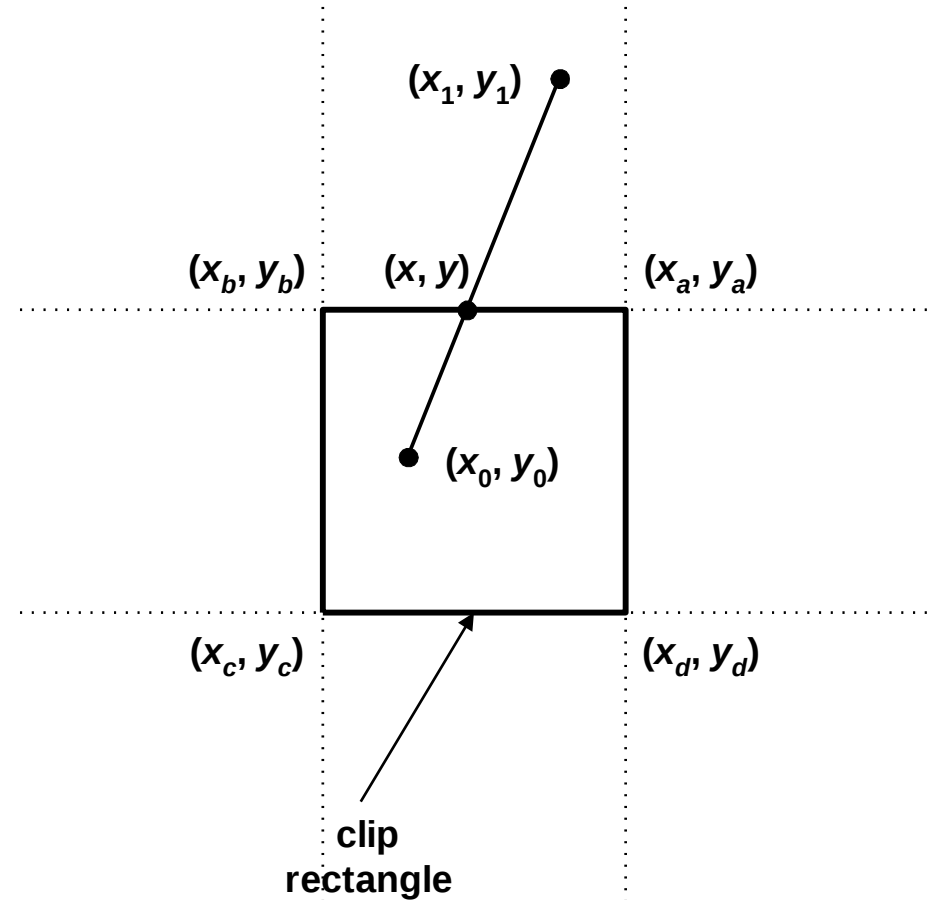
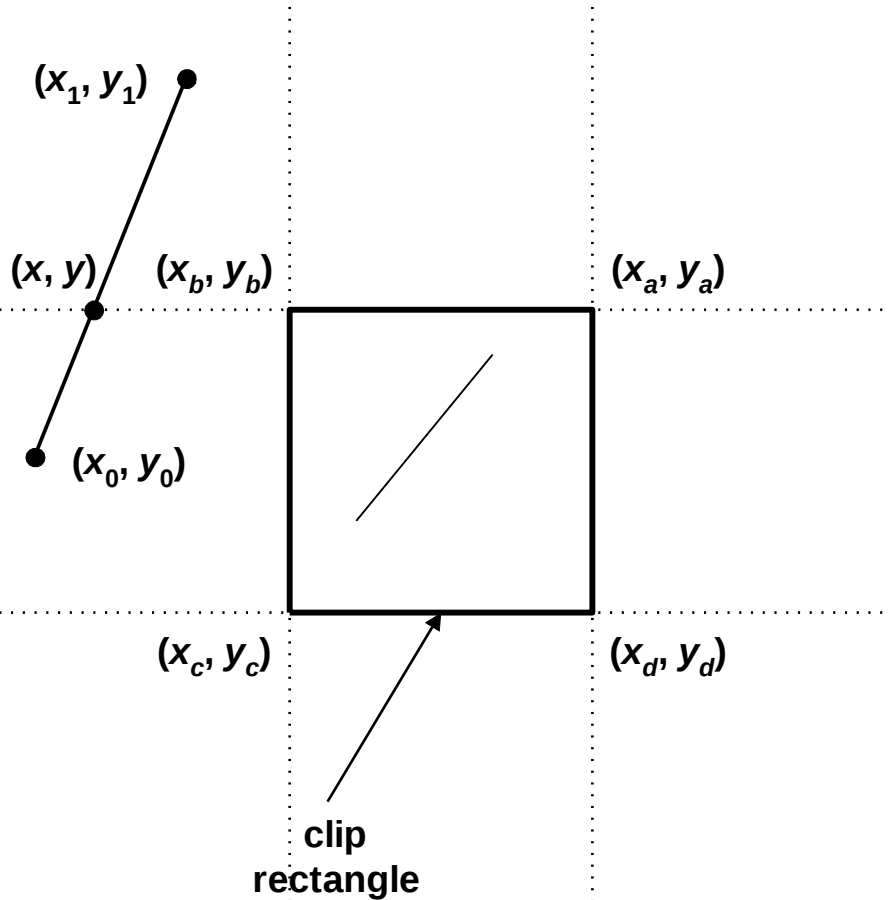
Zoom



- الانسحاب
- تغيير القياس
- تحديد الأجزاء المرئية

Line Clipping

Clipping Lines by Solving Simultaneous Equations



$$x = x_0 + t_{line}(x_1 - x_0), \quad y = y_0 + t_{line}(y_1 - y_0)$$

$$x = x_a + t_{edge}(x_b - x_a), \quad y = y_a + t_{edge}(y_b - y_a)$$

Example

- Line P_0P_1 where $P_0(x_0, y_0) = (2, 3)$, $P_1(x_1, y_1) = (4, 7)$
- Edge AB where $A(x_a, y_a) = (5, 5)$, $B(x_b, y_b) = (1, 5)$
- Intersection point $P(x, y)$?

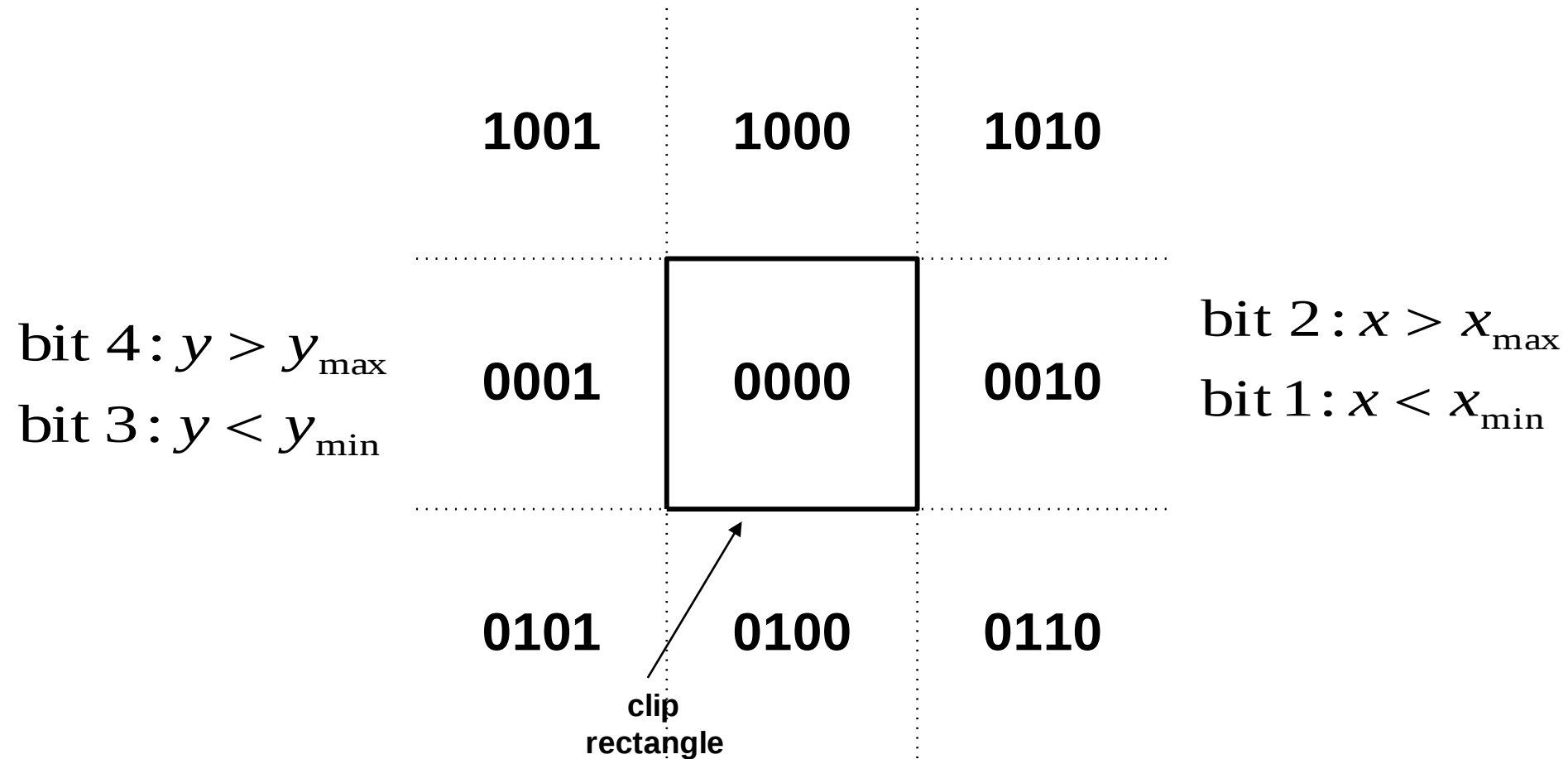
Answer:

$P = (3, 5)$

Cohen-Sutherland Algorithm

- The Cohen-Sutherland Line-Clipping Algorithm performs initial tests on a line to determine whether intersection calculations can be avoided.
 1. First, end-point pairs are checked for Trivial Acceptance.
 2. If the line cannot be trivially accepted, region checks are done for Trivial Rejection.
 3. If the line segment can be neither trivially accepted or rejected, it is divided into two segments at a clip edge, so that one segment can be trivially rejected.
 - These three steps are performed iteratively until what remains can be trivially accepted or rejected.

Cohen-Sutherland Algorithm



Region outcodes

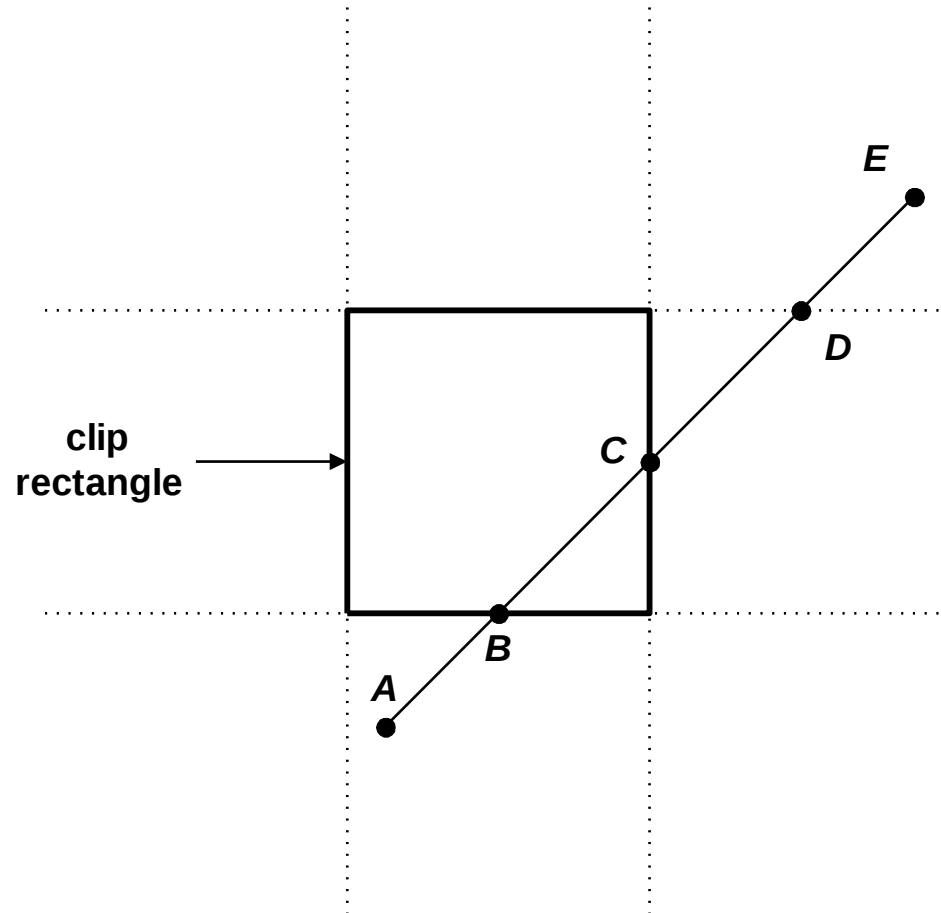
Cohen-Sutherland Algorithm

1. A line segment can be trivially accepted if the outcodes of both the endpoints are zero.
2. A line segment can be trivially rejected if the logical AND of the outcodes of the endpoints is not zero.
3. A key property of the outcode is that bits that are set in nonzero outcode correspond to edges crossed.

Algorithm

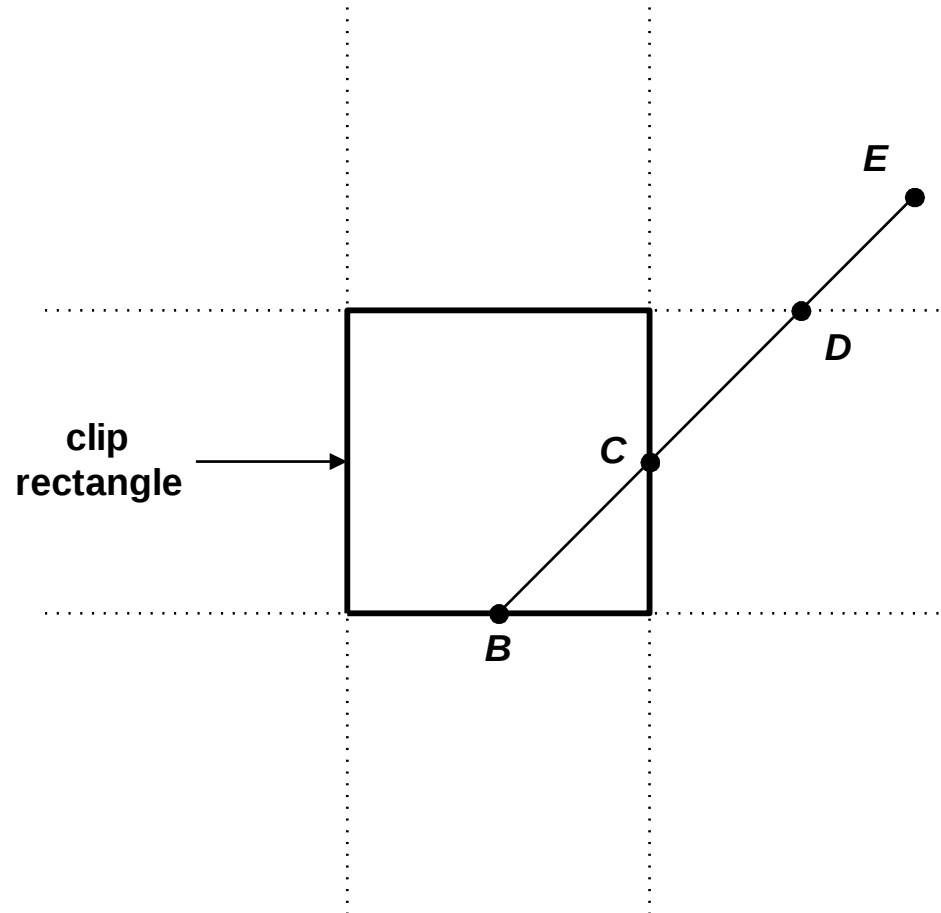
- 1-Compute the codes for the Two end points
- 2-Enter in loop, check if both outcodes are zero(0000 and 0000) put line in display file for display and exit loop, return
- 3-if both outcodes are not zero then take logical AND of both codes, check result for nonzero if so reject line exit loop, return
- 4-if result is zero then subdivide the line from intersection point of line and clipping boundary and repeat step 2,3,4

Cohen-Sutherland Algorithm



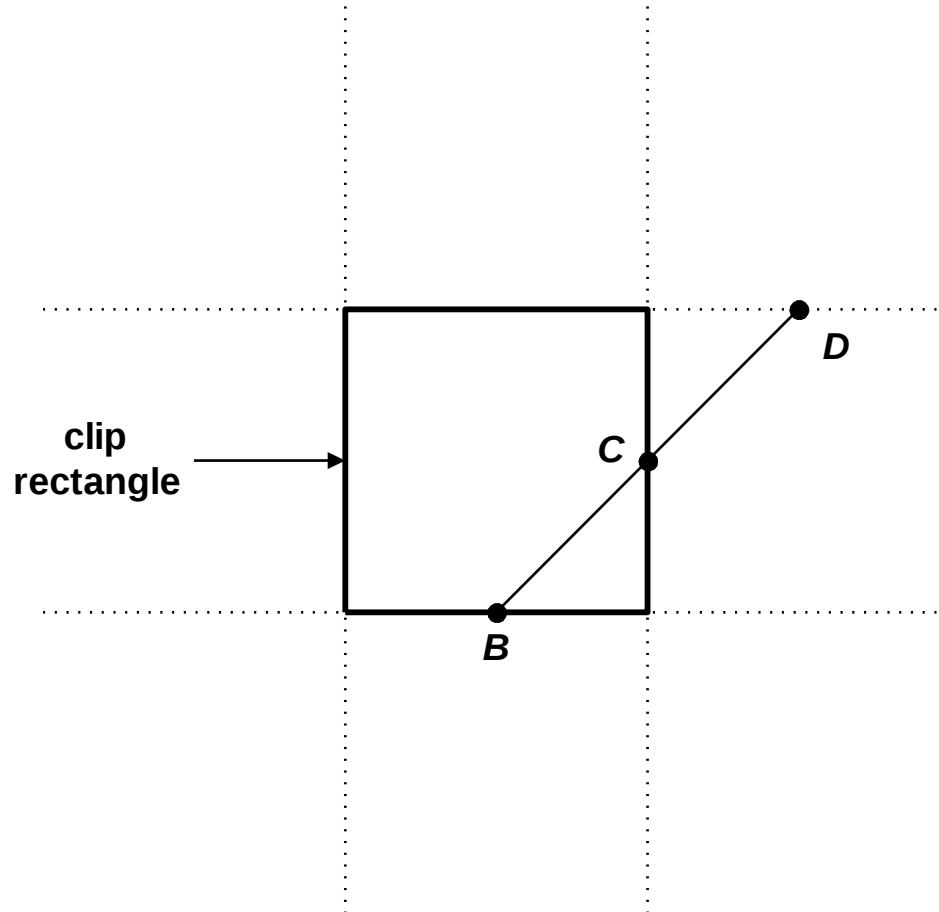
An Example

Cohen-Sutherland Algorithm



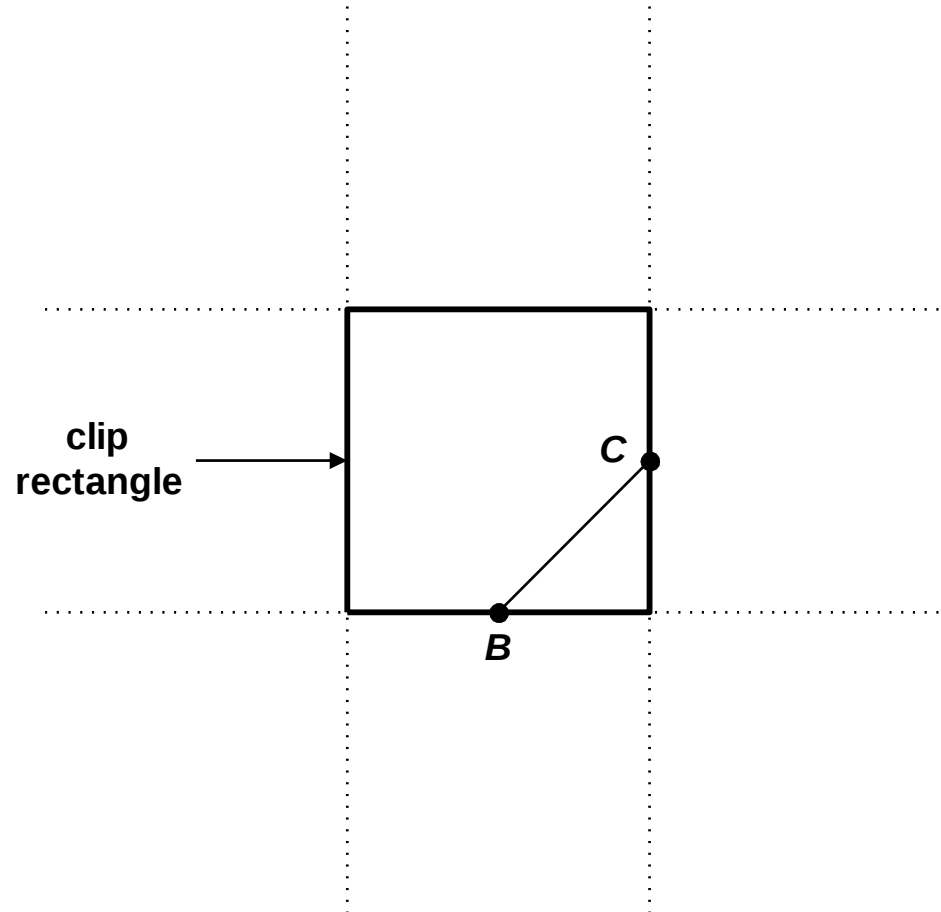
An Example

Cohen-Sutherland Algorithm



An Example

Cohen-Sutherland Algorithm



An Example

تطبيق

- النافذة : $(0,0)$ $(1,1)$
- المستقيم 1: $p_0(1/2,1/2)$ والنقطة $p_1(1/4,3/4)$
 - ترميز p_0
 - ترميز p_1
 - حالة المستقيم
- المستقيم 2: $p_2(3,3)$ والنقطة $p_3(-2,5)$
 - ترميز p_2
 - ترميز p_3
 - حالة المستقيم
- المستقيم 3: $p_4(3,3)$ والنقطة $p_5(0,1/2)$
 - ترميز p_4
 - ترميز p_5
 - حالة المستقيم

$I(3/5,1)$

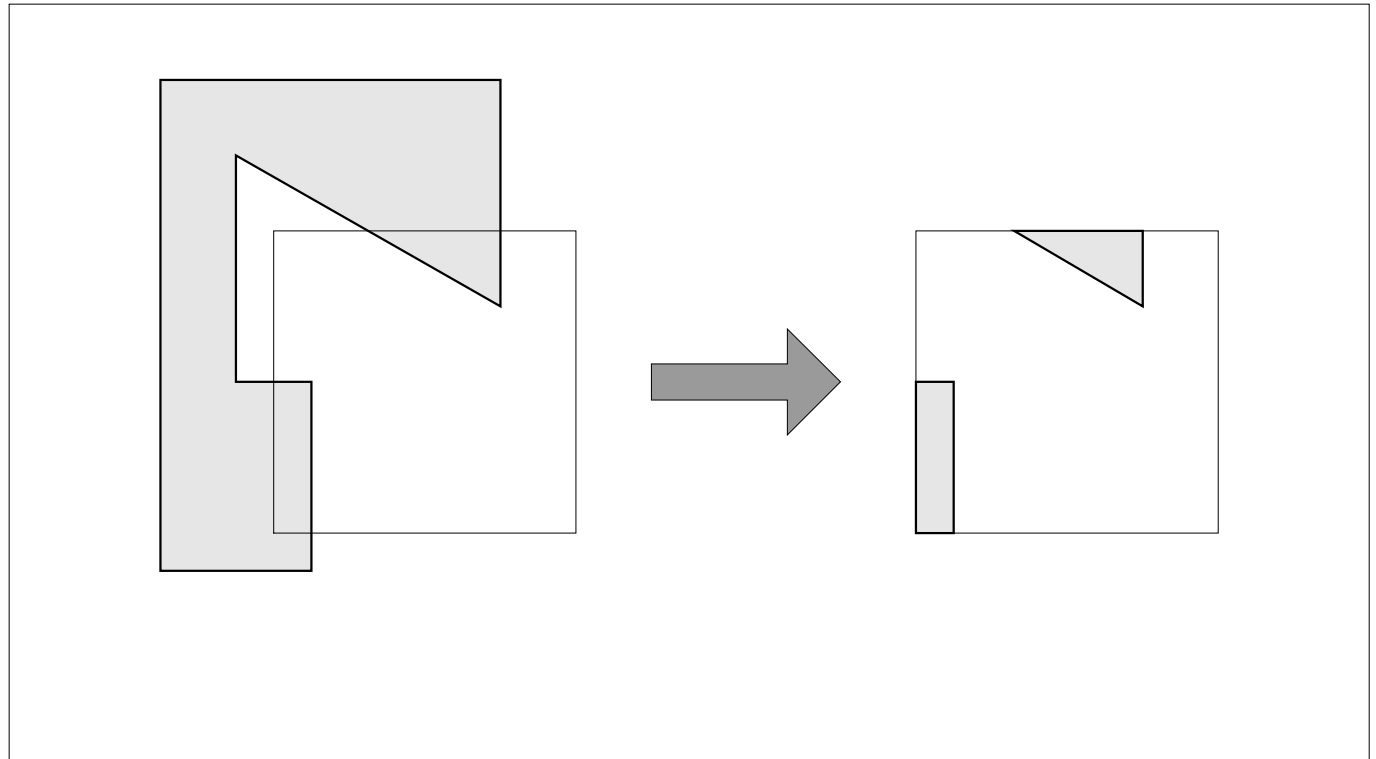
تقليم مضلع clipping polygon

تقليم مضلع $\neq$ تقليم عدة مستقيمات للأسباب التالية:

- الدخل: مجموعة الرؤوس $(v_0, v_1, \dots)$.

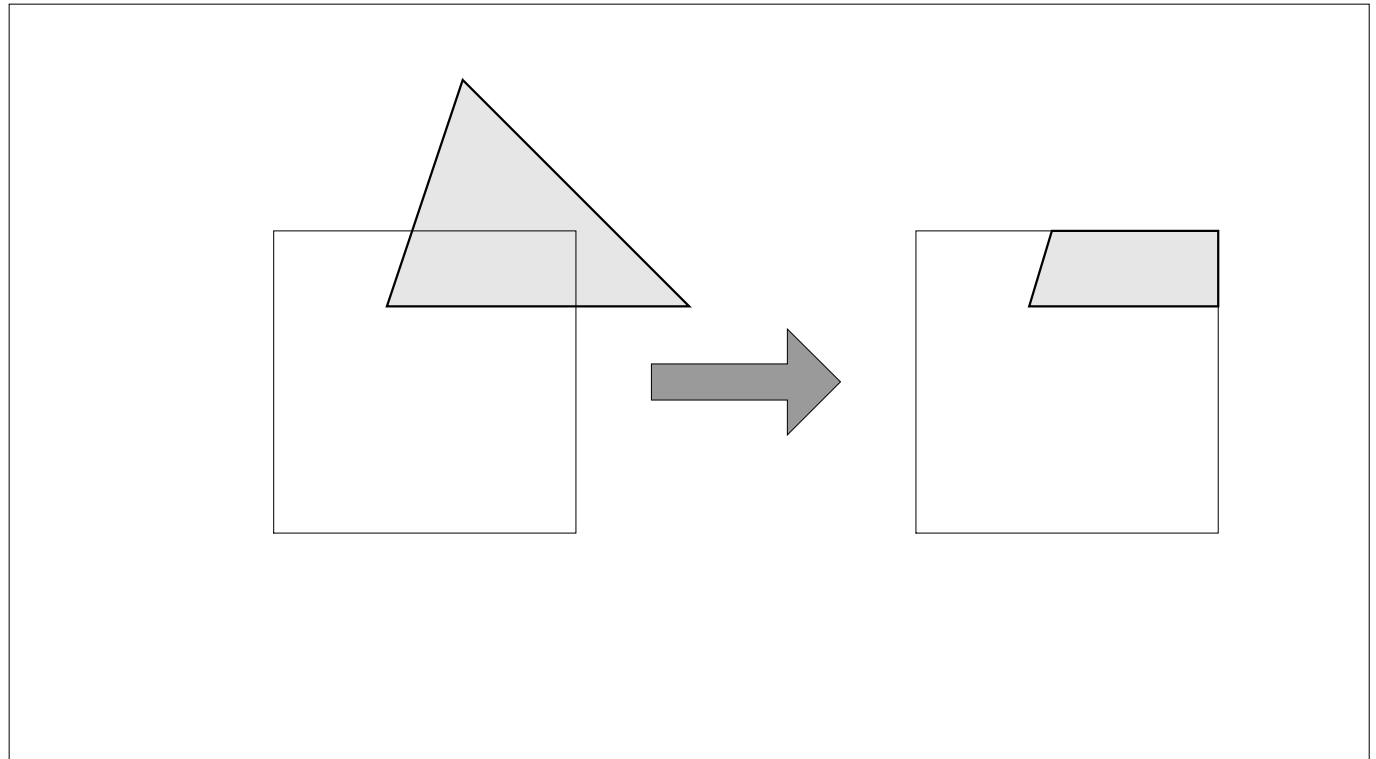
- الخرج: مضلع أو أكثر.

Polygon Clipping



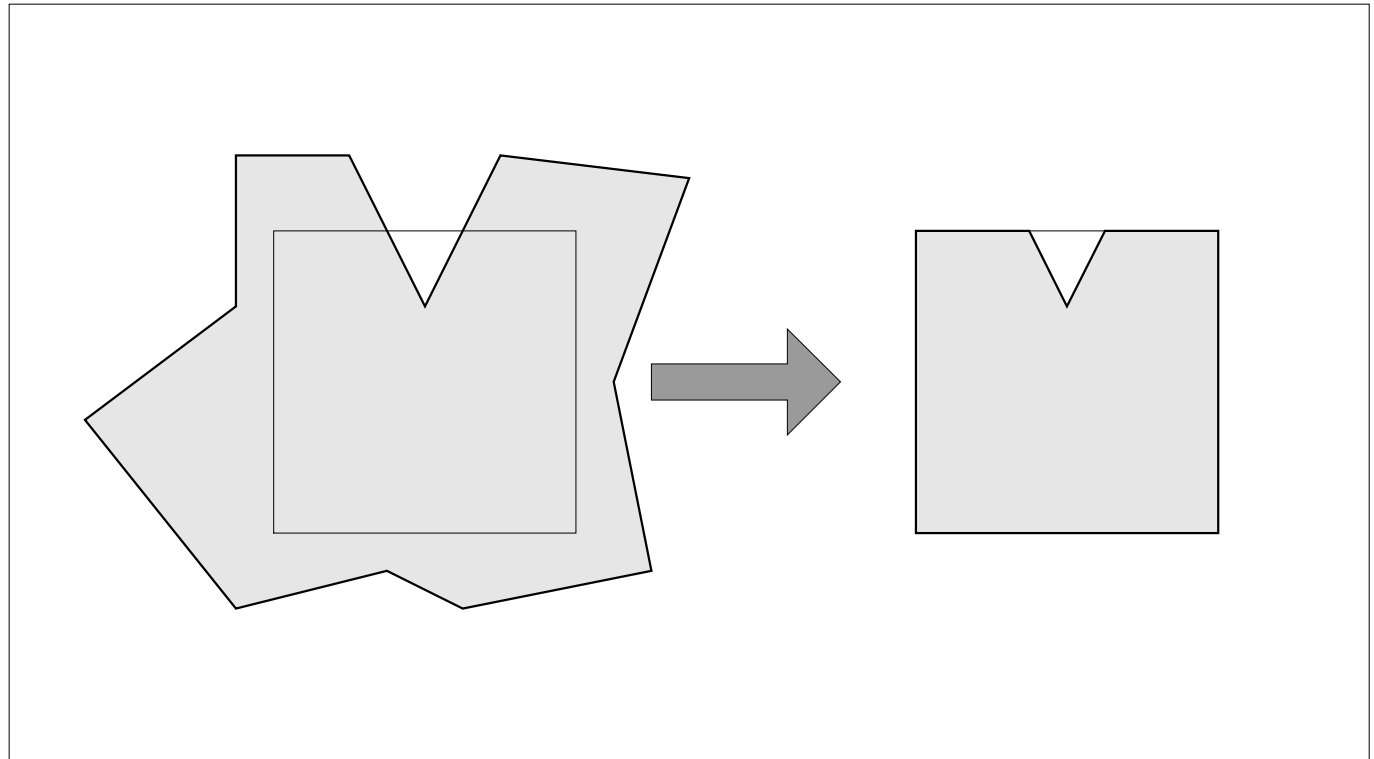
Example

Polygon Clipping



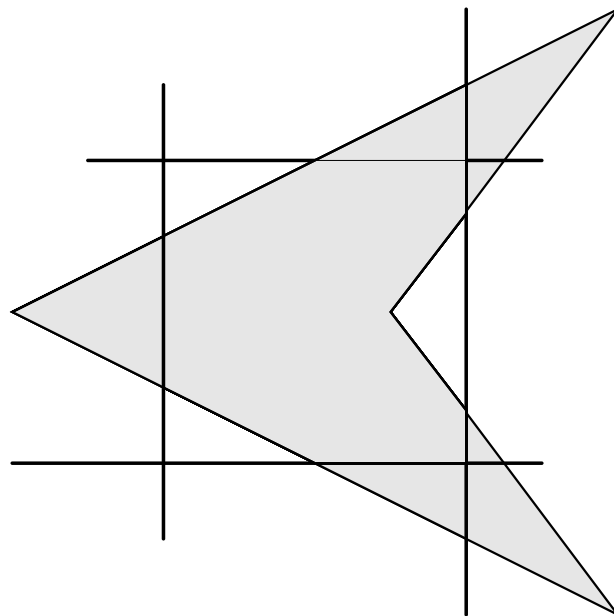
Example

Polygon Clipping



Example

Sutherland-Hodgeman Algo.



The Clipped Polygon

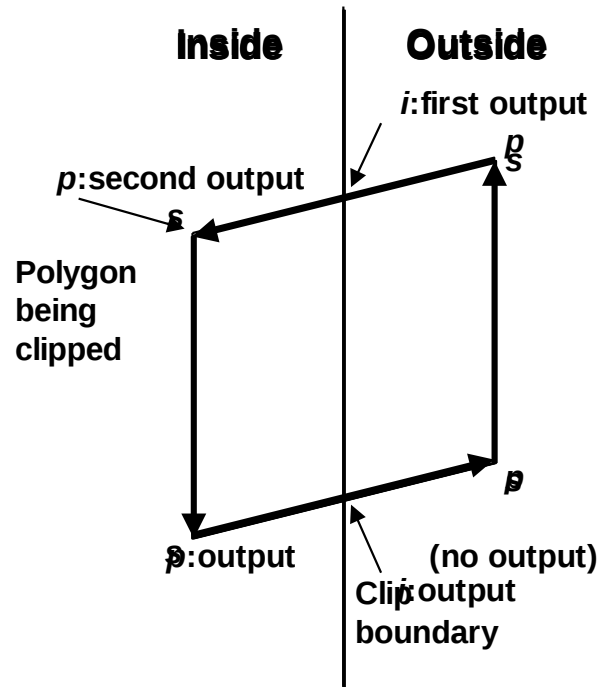
Clipping of the polygon

Clip Left --→ Clip right --→ Clip bottom ---→ Clip top
---→ View transformation

Consider Any Edge (P1P2)

1. If both s, p are left to edge, p is placed vertex
output list of clipped poly
2. If s, p are right to edge discard
3. If s, p cross edge and find intersection point (I)
if s is left to edge then I will be in output list of
vertex of clipped poly
if s is right then both p and I in output list

4 Cases of Polygon Clipping



Case 1

Determination of point if is left or right to line

AB is line segment(x_1, y_1 and x_2, y_2) determine point p
(x, y) is left or right to AB

Find cross product of vectors AB and AP

then resulted vector has direction vector k

then point p is left to AB if the sign of cross product is
positive

$$AP = (x - x_1) * i + (y - y_1) * j$$

$$AB = (x_2 - x_1) * i + (y_2 - y_1) * j$$

$$AB \times AP = [(x_2 - x_1) * (y - y_1) - (y_2 - y_1) * (x - x_1)] * k$$

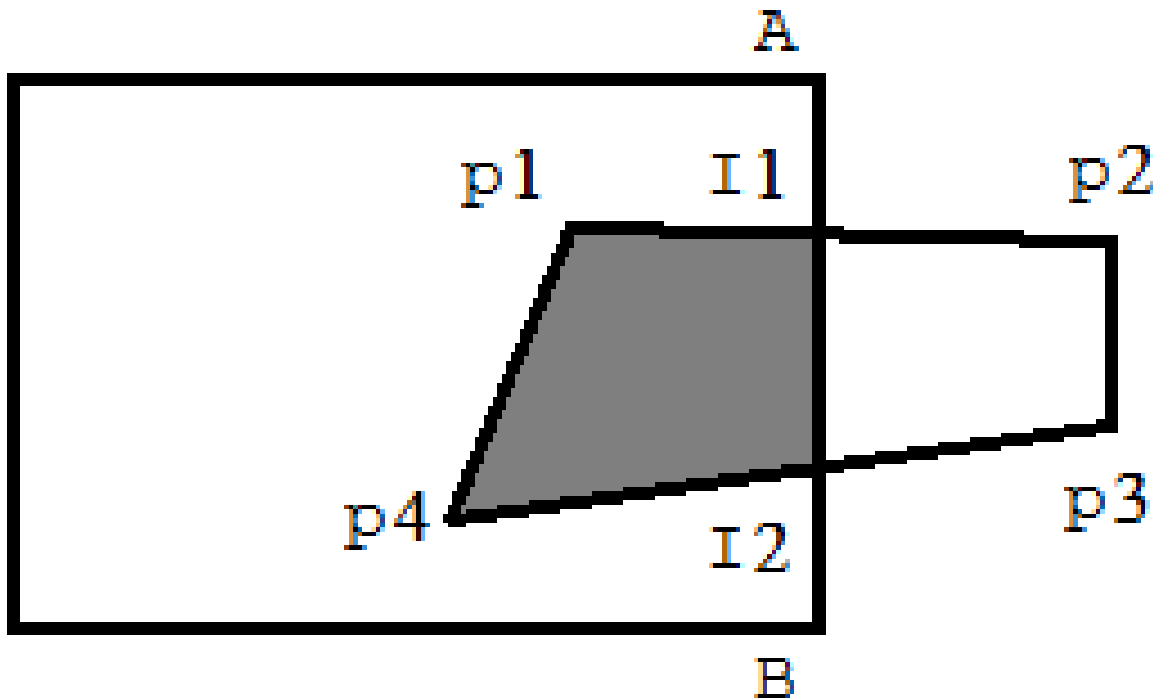
$$d = (x_2 - x_1) * (y - y_1) - (y_2 - y_1) * (x - x_1)$$

If $d = +$ then p is left to AB

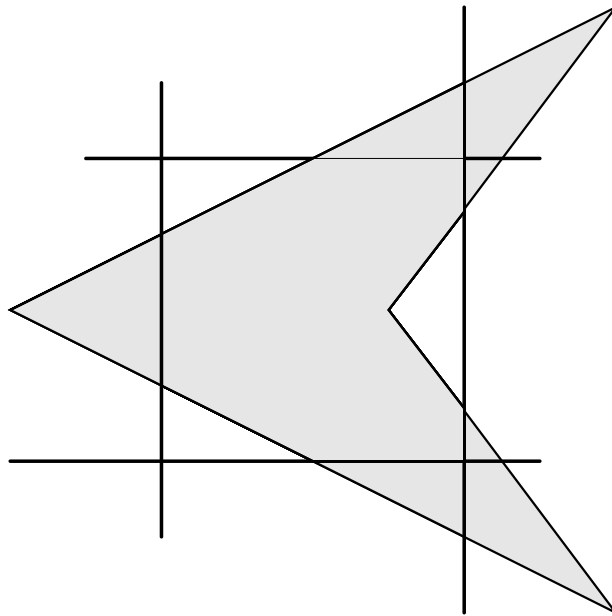
If $d = -$ then p is right to AB

Example 1

- $[p1, l1, l2, p4]$



Example 2



The Clipped Polygon

3D Clipping

- Both the Cohen-Sutherland and Cyrus-Beck clipping algorithm readily extend to 3D.
- For Cohen-Sutherland algorithm use two extra-bit in outcode for incorporating $z < z_{\min}$ and $z > z_{\max}$ regions

